1977

Thayer County, Alexandria and Gilead Areas

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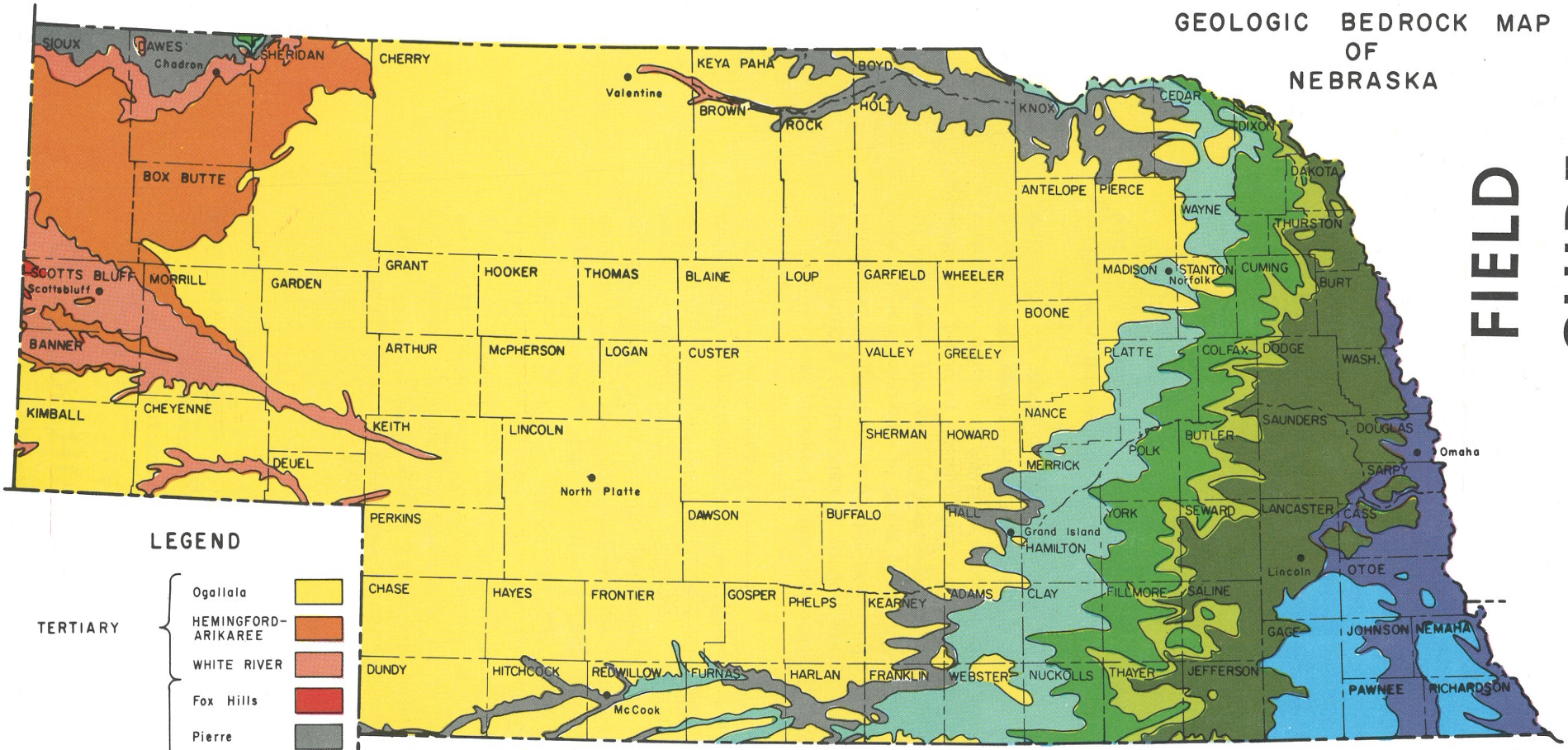
University of Nebraska - Lincoln

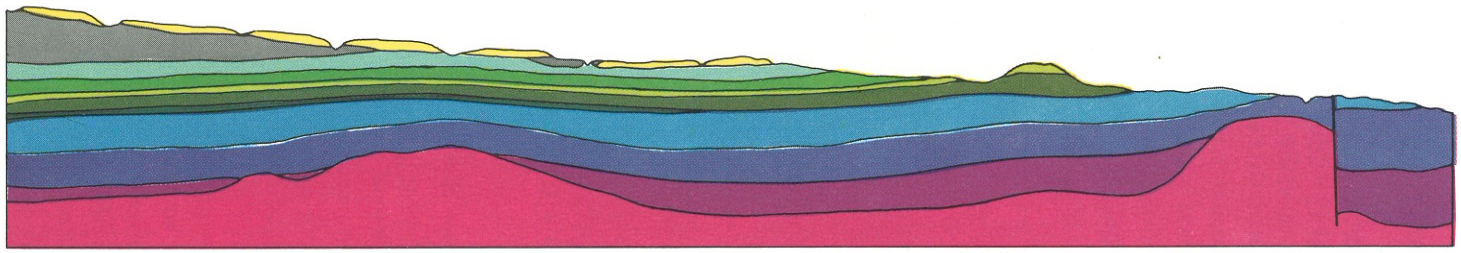
GEOLOGIC BEDROCK MAP OF NEBRASKA

FIELD GUIDE



LEGEND

- TERTIARY
  - Ogallala
  - HEMINGFORD-ARIKAREE
  - WHITE RIVER
- CRETACEOUS
  - Fox Hills
  - Pierre
  - Niobrara
  - Carlile
  - Greenhorn–Graneros
  - DAKOTA
- JURASSIC
- PERMIAN
- PENNSYLVANIAN
- MISSISSIPPIAN
- DEVONIAN
- SILURIAN
- ORDOVICIAN
- CAMBRIAN
- PRECAMBRIAN



Cross Section Along Southern Nebraska Border

20 0 20 40 60
Scale in Miles

NOTE: Unconsolidated sediments of Pleistocene age cover the bedrock throughout much of the State and are not sh

FG-5 $1.00

THE UNIVERSITY OF NEBRASKA
CONSERVATION AND SURVEY DIVISION

GEOLOGICAL SURVEY
WATER SURVEY
SOIL SURVEY
INFORMATION SURVEY

PUBLISHED IN COOPERATION WITH:
NEBRASKA GEOLOGICAL SOCIETY
LINCOLN GEM & MINERAL CLUB

PREFACE

In recent years the earth sciences have become an important part of the curricula of many school systems. In the past, pupils were given only a smattering of geology, paleontology, mineralogy, etc. to help them better understand the world around them. Recent emphasis on the earth sciences has created a demand from teachers and students for geologic information in the area in which they live. In response to this demand in Nebraska, Educational Circular No. 1, "Record in Rock," and Educational Circular No. 2, "Minerals and Gemstones of Nebraska," were prepared. In addition to the educational emphasis on earth sciences, rock collecting has grown to be one of the nation's most popular hobbies. Many students and hobbyists are now requesting information on how to identify the various stratigraphic horizons (rock layers) and geologic features they encounter in the field. Thus, these field guides have been prepared to help the nonprofessional familiarize himself with the stratigraphy and some of the geologic phenomena of Nebraska.

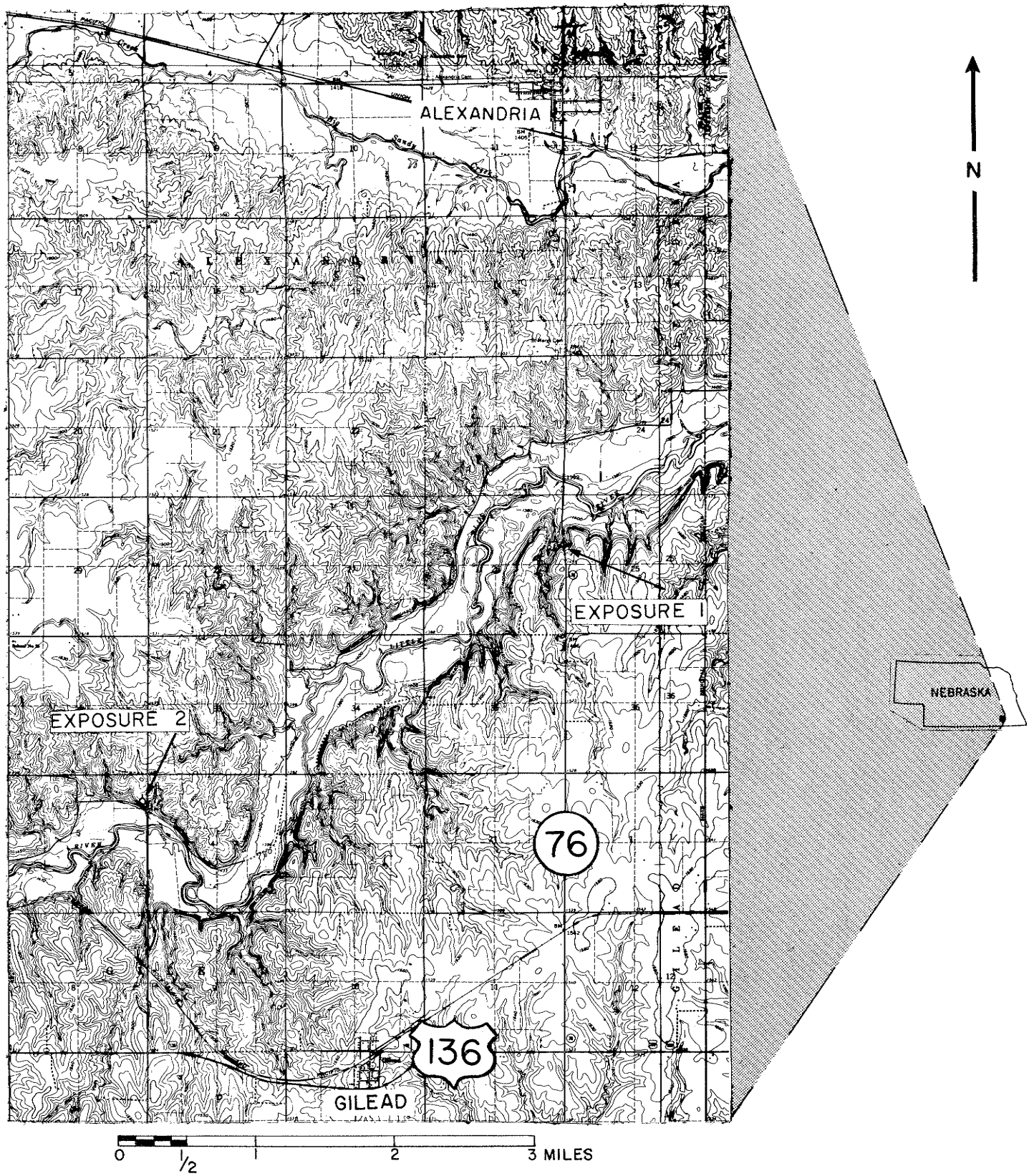
The locations presented herein were chosen for several reasons. All are on public property so that viewing them is always possible. All are easily reached by car and are generally accessible even to the elderly or handicapped. All provide "typical" examples of either common Nebraska rocks, minerals, or fossils. In addition to the brief description of the stratigraphy and the rocks, minerals, and fossils found in the outcrops, a brief description of the land forms within view of the outcrop is given. It is hoped that this information will orient the student to the geology of Nebraska and help him to understand the processes responsible for the landscape about him.

One safety note: when visiting these outcrops, be sure that your car is parked well off of the road—if your car is equipped with safety blinkers, use them.

The Conservation and Survey Division of the University is the agency designated by statute to investigate and interpret the geologically related natural resources of the state, to make available to the public the results of these investigations, and to assist in the development and conservation of these resources.

The Division is authorized to enter into agreements with federal agencies to engage in cooperative surveys and investigations in the state. Publications of the Division and the cooperating agencies are available from the Conservation and Survey Division, University of Nebraska, Lincoln 68508.

Publication and price lists are furnished upon request.



LOCATIONS AND ELEVATIONS OF EXPOSURES

Exposure 1 is situated in the SW 1/4, NW 1/4, sec. 25, T-3-N, R-1-W, Thayer County. The elevation ranges from 1,420 feet to 1,470 feet above sea level.

Exposure 2 is situated in the NE 1/4, NE 1/4, sec. 5, T-2-N, R-1-W, Thayer County. The elevation ranges from 1,410 feet to 1,460 feet above sea level.

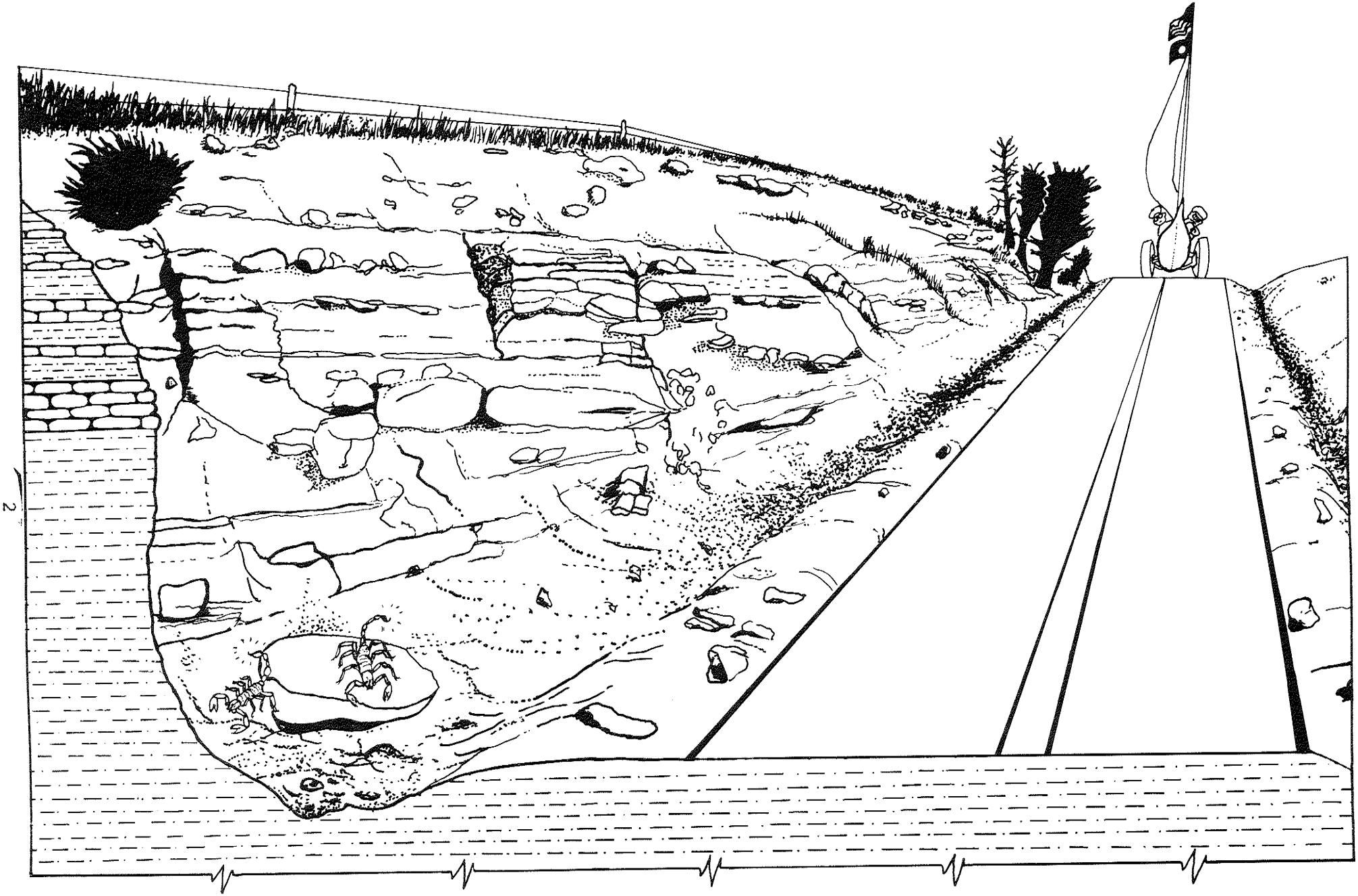


Figure 2.---Idealized section at exposure one. Note that slumping may alter the appearance of the section

EXPOSURES NEAR GILEAD AND ALEXANDRIA

These exposures are thick sections of Upper Cretaceous shales and limestones with some bentonites. Though well known and easily accessible, they have not been studied in great detail.

HOW TO FIND THE EXPOSURES

Use a Nebraska highway map to proceed to Alexandria, Nebraska. Locate the Union Pacific Railroad crossing at the south end of Alexandria. Proceed in a southerly direction along State Highway 76 for 3.0 miles. Exposure 1 is on the left (east) side of the highway.

To locate exposure 2, go to Gilead 3.6 miles south and 1.5 miles west of exposure 1. From the western edge of Gilead go west on U. S. Highway 136 for 1.6 miles. Turn right (north) onto the county road from Highway 136. Go north, crossing the Little Blue River, for 1.7 miles to the junction between county roads. Exposure 2 is on the left and on the north side of the east-west trending county road.

STRATIGRAPHIC SECTION AT EXPOSURE ONE
Figure 2

PLEISTOCENE LOESS AND GRAVELS AT TOP OF EXPOSURE

CRETACEOUS SYSTEM: COLORADO GROUP:

GREENHORN-GRANEROS FORMATIONS

A measured section of this exposure is not presently available. The exposure, however, does provide the student with an excellent example of the chalky shales and limestones laid down by Upper Cretaceous seas. The upper part of the section is quite chalky and fossiliferous. Several beds appear to be composed almost entirely of clam shells of a single species, or of belemnite shells. Oysters and ammonites may also be found here.

The lower part of the section at exposure 1 is in a feed lot on private property, but may be observed from the road right-of-way to contain several beds of bentonite. Bentonitic clay is an altered volcanic ash that swells considerably when moistened and which, because of this property, is used for well-drilling mud. The upper and lower contacts of the bentonite beds are very sharply defined in contrast to contacts between other beds. These beds are evidence of extensive volcanic activity in Late Cretaceous time.

CAUTION: Scorpions are common at this exposure; their sting may be very painful or even fatal. If stung, contact a physician immediately.

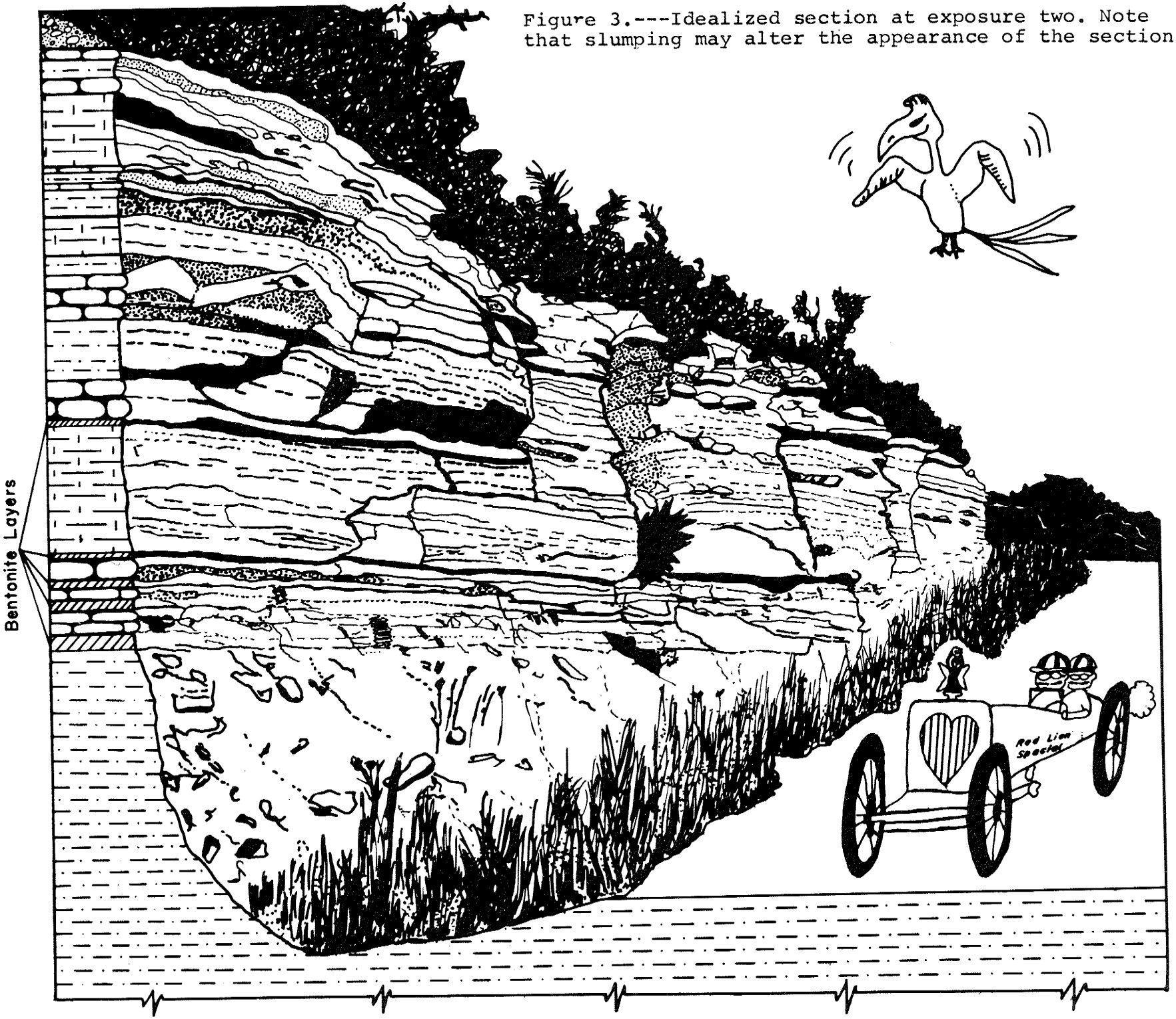


Figure 3.---Idealized section at exposure two. Note that slumping may alter the appearance of the section.

STRATIGRAPHIC SECTION AT EXPOSURE TWO
Figure 3

PLEISTOCENE LOESS AND GRAVELS AT TOP OF EXPOSURE

CRETACEOUS SYSTEM: COLORADO GROUP:

GREENHORN-GRANEROS FORMATION

A measured section of this exposure is not presently available. Exposure 2 also provides an excellent example of the chalky shales and limestones laid down by a Late Cretaceous sea. Bentonite beds are also present in this exposure. It has not been established if any of the bentonite beds at exposure 2 are the same beds as those found at exposure 1. If such a relationship between bentonite beds can be determined, geologists can use these "marker beds" to correlate the rock strata of exposure 1 and exposure 2.

GEOLOGIC HISTORY

Both exposures 1 and 2 are classic examples of deposits laid down by muddy, shallow oceans. These rocks are remnants of the last marine invasion of the midcontinent approximately 100 million years ago. The bentonites are evidence of volcanic activity which was probably happening in the Rocky Mountains of Colorado and New Mexico. As the ranges were being uplifted, active volcanoes produced ash which was carried by the wind and laid down in broad sheet deposits over large areas.

WHILE YOU ARE THERE

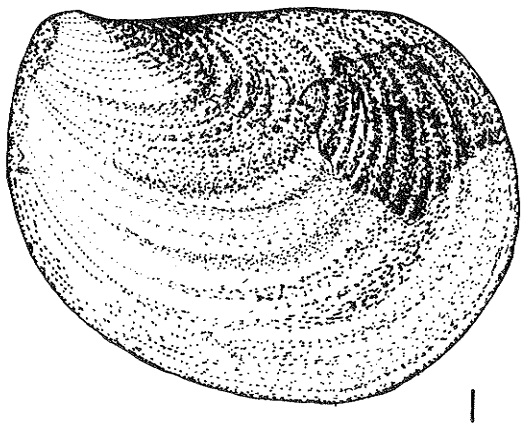
Observe the coarse sand and gravel covering the hills. These were deposited by much older streams than the Little Blue River which now occupies the valley below the bedrock outcrops. These older streams were flowing into this area before and during the Ice Age (Pleistocene) when glaciers moved down over extreme eastern Nebraska. We can see that the more recent erosion by the Little Blue River has cut more deeply into the present land surface, leaving the older stream deposits perched on terraces and hillsides.

Both these sands and gravels and the limestones have commercial value in this area. The limestone is utilized as agricultural lime and the sand and gravel as concrete aggregate and road stone.

SOME COMMON FOSSILS YOU MAY FIND
Figure 4

1. A clam, Inoceramus
2. An oyster, Gryphea
3. Fish vertebra, ? Portheus
4. Shark tooth, Squalicorax
5. Ray tooth, Ptychodus
6. Belemnites, Belemnitella
7. Ammonite, Prionocyclus

More information about these, and other fossils is available in the Conservation and Survey Division's Educational Circular No. 1, "Record in Rock."



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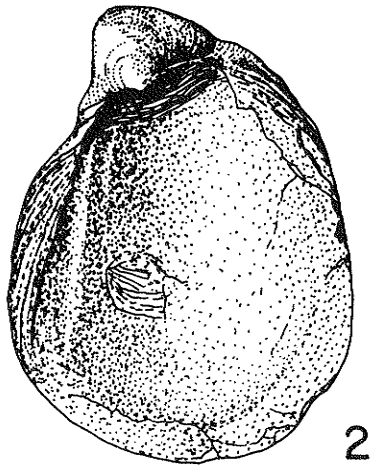

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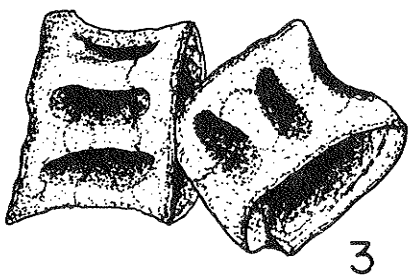

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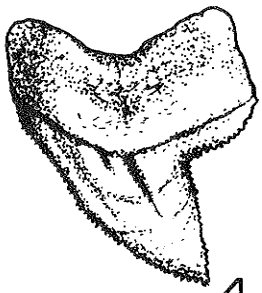

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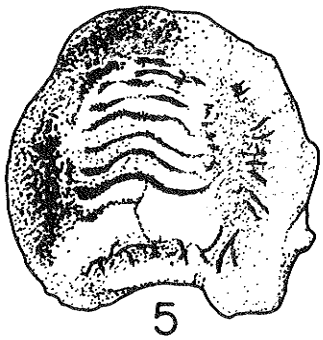

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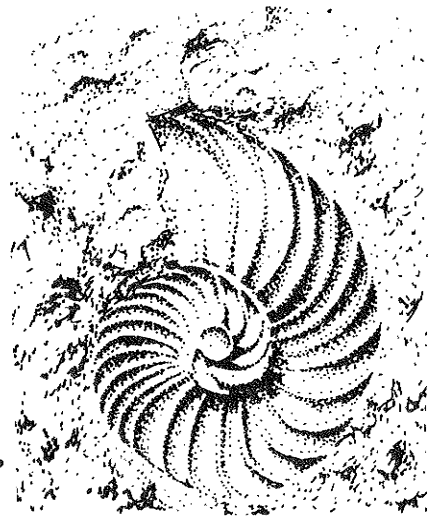

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NOTES

Some Additional Publications Available from the Conservation and Survey Division

RECORD IN ROCK, A Handbook of the Invertebrate Fossils of Nebraska: *Roger K. Pabian,* Educational Circular No. 1 (1970).

MINERALS AND GEMSTONES OF NEBRASKA, A Handbook for Students and Collectors: *Roger K. Pabian,* Educational Circular No. 2 (1971).

SOILS OF NEBRASKA: *J. A. Elder,* Resource Report No. 2 (1969).

DIRECTORY OF NEBRASKA QUARRIES, PITS, AND MINES:*R. R. Burchett,* Resource Report No. 5 (1971).

CENTENNIAL GUIDEBOOK TO THE GEOLOGY OF NEBRASKA: *R. R. Burchett and E. C. Reed* (1967).

GUIDEBOOK TO THE GEOLOGY ALONG THE MISSOURI RIVER BLUFFS OF SOUTHEASTERN NEBRASKA AND ADJACENT AREAS: *R. R. Burchett* (1970).

GUIDEBOOK TO THE GEOLOGY ALONG PORTIONS OF THE LOWER PLATTE RIVER VALLEY AND WEEPING WATER VALLEY OF EASTERN NEBRASKA: *R. R. Burchett* (1971).

THE GEOLOGICAL SECTION OF NEBRASKA: *G. E. Condra and E. C. Reed,* Nebraska Geological Survey Bulletin No. 14A (1943, revised 1959).

REVISION OF THE CLASSIFICATION OF THE PLEISTOCENE DEPOSITS OF NEBRASKA: *E. C. Reed and V. H. Dreeszen,* Nebraska Geological Survey Bulletin No. 23 (1965).

GEOLOGICAL MAP OF NEBRASKA: Compiled by *R. R. Burchett,* 1:1,000,000 Scale (1969).

TOPOGRAPHIC MAPS: Topographic Map Division, U.S. Geological Survey.

AGE	GEOLOGIC TIME UNITS		ROCK TYPES	MINERAL RESOURCES AND PRODUCTS	TYPICAL FOSSILS
MILLIONS OF YEARS AGO	CENOZOIC (RECENT LIFE)	PLEISTOCENE	Glacial till, silt, clay, sand, gravel, volcanic ash.	Agricultural soil, water, sand & gravel, volcanic ash.	MAMMALS: MAMMOTH
2		TERTIARY	Sandstone, siltstone, clay, gravel, marl, volcanic ash.	Agricultural soil, water, sand & gravel, volcanic ash, riprap.	
70	MESOZOIC (MIDDLE LIFE)	CRETACEOUS	Chalk, chalky shale, dark shale, varicolored clay, sandstone, conglomerate	Water, oil & gas, cement, brick, agricultural lime, & other construction materials.	REPTILES: DINOSAUR
135		JURASSIC	Subsurface only. Sandstones and shales		
180		TRIASSIC			PLESIOSAUR
225	PALEOZOIC (ANCIENT LIFE)	PERMIAN	Shale, limestone, dolomite, gypsum, anhydrite, sandstone, siltstone, chert.	Water, agricultural lime, oil, road rock, riprap.	AMPHIBIANS
280		PENNSYLVANIAN	Limestone, shale, sandstone, coal.	Oil, cement, brick, concrete aggregate, lightweight aggregate, road rock, agricultural lime, rip rap, water.	BRACHIOPOD
310		MISSISSIPPIAN	Subsurface only. Limestone, dolomite.	Oil, water.	
350		DEVONIAN	Subsurface only. Dolomite, gray shale.		FISH: CORALS
400		SILURIAN	Subsurface only. Dolomite.		
440		ORDOVICIAN	Subsurface only. Dolomite, sandstone, shale.		INVERTEBRATES: CRINOID
500		CAMBRIAN	Subsurface only. Dolomite, sandstone.		TRILOBITE
600	CRYPTOZOIC (HIDDEN LIFE)	PRECAMBRIAN	Subsurface only. Granite, other igneous rocks, and metamorphic rocks.		?
? 5,000					